MachXO2 Pico Development Kit

User's Guide

October 2012
Revision: EB61_02.0

Introduction

Thank you for choosing the Lattice Semiconductor MachXO2™ Pico Development Kit.

This guide describes how to begin using the MachXO2 Pico Development Kit, an easy-to-use platform for rapidly prototyping system control designs using MachXO2 PLDs. Along with the evaluation board and accessories, this kit includes the pre-loaded Pico SoC Demo (Environment Scanning Demonstration Design) that demonstrates board diagnostic functions including ultra-low power, LCD driver, I/O control, current measuring, time stamps and data logging to non-volatile memory using the 8-bit LatticeMico8™ microcontroller.

The contents of this user's guide include demo operation, top-level functional descriptions of the various portions of the evaluation board, descriptions of the on-board connectors, switches, a complete set of schematics and the bill of materials for the MachXO2 Pico Evaluation Board.

Note: Static electricity can severely shorten the lifespan of electronic components. See the MachXO2 Pico Development Kit QuickSTART Guide for handling and storage tips.

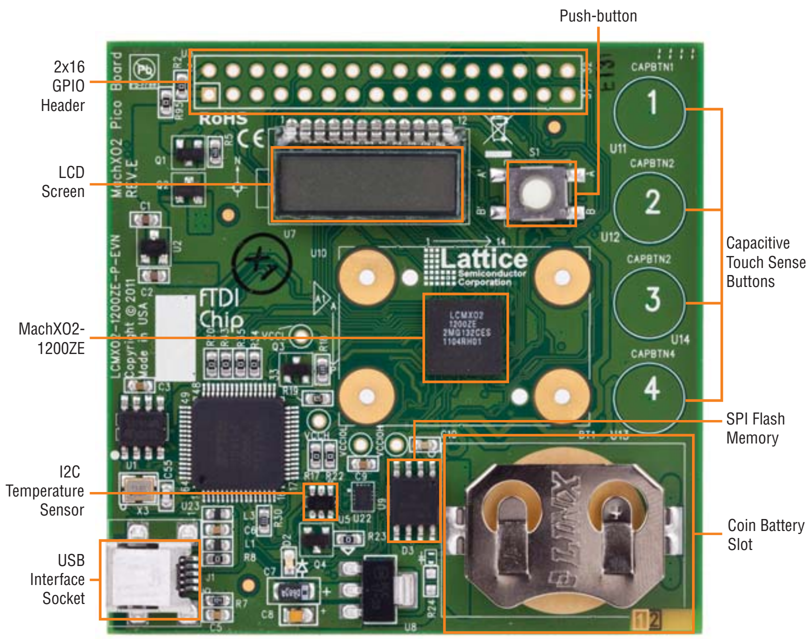
Features

The MachXO2 Pico Development Kit includes:

- **MachXO2 Pico Evaluation Board** – The MachXO2 Pico Evaluation Board features the following on-board components and circuits:
  - MachXO2 LCMXO2-1200ZE PLD device in a 132-ball csBGA package. The board is designed for density migration, allowing a lower density MachXO2 device to be assembled on the board.
    - Part number LCMXO2-1200ZE-P-EVN is populated with the R1 silicon. Part number LCMXO2-1200ZE-P1-EVN is populated with the Standard silicon. The demos have been targeted for a specific version of silicon and are not interchangeable. For more information on the R1 to Standard migration refer to AN8086, Designing for Migration from MachXO2-1200-R1 to Standard (Non-R1) Devices
    - 4 Mbit SPI Flash memory
  - Current sensor circuits using Delta-Sigma ADC
  - LCD driven with PWM analog output circuitry
  - Expansion header for JTAG, SPI, I^2C and PLD I/Os
  - 4 capacitive touch sense buttons
  - Standard USB cable for device programming
  - RS-232/USB and JTAG/USB interface
  - RoHS-compliant packaging and process
  - USB or 2032 battery powered
- **Pre-loaded Reference Designs and Demo** – The kit includes a pre-loaded Pico SoC Demo design that integrates several Lattice reference designs including: the LatticeMico8 microcontroller, master WISHBONE bus controller, soft delta-sigma ADC, SPI master controller, UART peripheral, Embeded Block RAM and additional control functions.
- **USB connector Cable** – A mini B USB port provides power, a communication and debug port via a USB-to-RS-232 physical channel and programming interface to the MachXO2 JTAG port.
- **Battery** – A 2032 coin battery can provides an alternate source of power.
- **QuickSTART Guide** – Provides information on connecting the MachXO2 Pico Evaluation Board, installing Windows hardware drivers, and running the Pico SoC Demo.

Figure 1 shows the top side of the MachXO2 Pico Evaluation Board with comments on the specific features that are designed in the board.

Figure 1. MachXO2 Pico Evaluation Board, Top Side



MachXO2 Device

This board features a MachXO2 PLD with a 1.2V core supply. The PLD is packaged in a 132-ball csBGA which provides a migration path to devices ranging from 640 LUTs to 4340 LUTs. A complete description of this device can be found in the MachXO2 Family Handbook.

Software Requirements

You should install the following software before you begin developing designs for the evaluation board:

- Lattice Diamond™ 1.2 (or higher)
- ispVM™ System 17.9.1 (or higher)

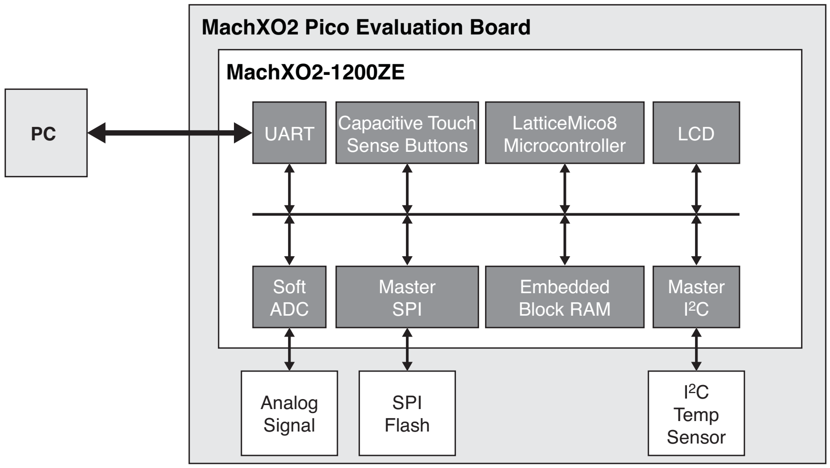
Demonstration Design

Lattice provides the Pico SoC Demo design programmed in the board. The design utilizes the MachXO2 in the context of low power applications.

The Pico SoC Demo illustrates the use of the LatticeMico8 microcontroller, associated peripherals and firmware to provide a low power system featuring voltage/current measurement, data logging to nonvolatile memory, I/O control, embedded block RAM utilization, UART communication, capacitive touch sense buttons and a LCD controller.

- The LatticeMico8 executable program initializes the peripherals that are embedded in the SoC design. During initialization, the LatticeMico8 uploads the user menu on the Terminal of a PC.
- Users interact with LatticeMico8 and the board through the Terminal of a PC or through the capacitive touch sense buttons.

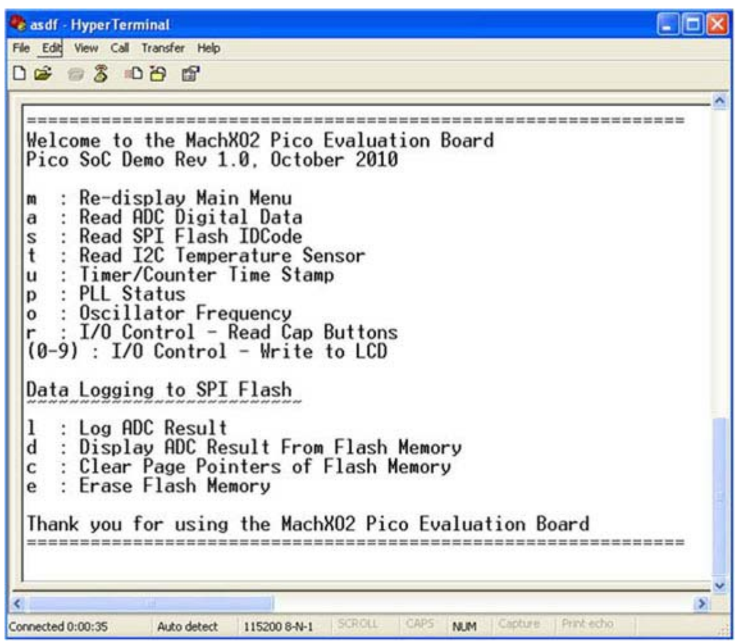
Figure 2. Pico SoC Demo Block Diagram



Power management is handled in two phases by the MachXO2 Pico Evaluation Board system:

1. MachXO2 Function – After the reset is de-asserted, LatticeMico8 initializes the peripherals embedded in the MachXO2 device and uploads the user menu onto the HyperTerminal window of a PC.

Figure 3. HyperTerminal User Menu



2. Users interact with LatticeMico8 microcontroller and the board by selecting the available options in the HyperTerminal menu. The available options are:

- '**m**' – This option re-displays the main menu anytime during the demonstration. PICO is displayed on the LCD screen.
- '**i**' – This option measures the Icc using a Delta Sigma. The result is displayed to the terminal and the LCD. Board button 3 performs the same function but results are only displayed to the LCD.
- '**o**' – This option measures Icco using Delta Sigma. The result is displayed to the terminal and the LCD. Pressing board button 2 performs the same function but results are only displayed to the LCD.

- '**s**' – This option reads the device ID of the SPI Flash on the board. The results are displayed to the terminal and the LCD.
- '**t**' - This option reads the I2C temperature sensor on the board. The result is displayed to the Terminal and to the LCD. Button 4 on the board performs the same function but the result is only displayed on the LCD
- '**r**' This option samples the capacitive touch buttons on the board and displays the data in the terminal.
- "**0-9**" - These values will echoed to the terminal and displayed on the LCD
- '**l**' - This option will read the Icc, Icco, and Temperature and log it to the SPI flash memory. The WRITE page pointer will increment when 'l' is pressed. The initial value of the page pointer after power up is a 0. Button 1 on the board performs the same function the LCD will display 8888
- '**d**' - This option will read the data from the SPI Flash device and display to to the Terminal window. The READ page pointer will increment when 'd' is pressed. The intial value of the page pointer after a power up is 0.
- '**c**' - This option will clear (reset) the WRITE and READ page pointers
- '**e**' - This selection will perform a bulk-erase of the Flash memory in the SPI Flash device and will clear (reset) the WRITE and READ page pointers.

Setting up the Board

Drivers and Firmware

Before you begin, you will need to obtain the necessary hardware drivers for Windows from the Lattice web site.

1. Browse to www.latticesemi.com/alpha-mxo2-pico-kit and locate the hardware device drivers for the USB interface.

    2. Download the ZIP file to your system and unzip it to a location on your PC.

Linux Support:

The USB interface drivers for the evaluation board are included in Linux kernel 2.4.20 or greater, including distributions compatible with Lattice Diamond design software (Red Hat Enterprise v.3, v.4 or Novell SUSE Enterprise v.10).

The Pico SoC Demo is preprogrammed into the MachXO2 Pico Evaluation Board, however over time it is likely that your board will be modified.

To download the demo source files and reprogram the MachXO2 Pico Evaluation Board:

1. Download the demo appliction source code from www.latticesemi.com/alpha-mxo2-pico-kit.

    2. Use **.\Environment_Scanning_demo\project\impl1\Environment_Scanning_demo_impl1.jed** to restore the Environment Scanning demonstration design.

Connecting to the MachXO2 Pico Evaluation Board

1. Connect the evaluation board to your PC using the USB cable provided. The USB connector on the board includes reference designator J1. Once the connection is made, a blue LED with reference designator D2 will illuminate.

    2. If you are prompted "Windows may connect to Windows Update", select **No, not this time** from available options and click **Next** to proceed with the installation.
    3. Choose the **Install from specific location (Advanced)** option and click **Next**.
    4. Select **Search for the best driver in these locations** and click the **Browse** button to browse to the Windows driver folder created earlier. Select the **CDM 2.04.06 WHQL Certified** folder and click **OK**.
    5. Click **Next**. A screen will display as Windows copies the required driver files. Windows will display a message indicating that the installation was successful.

Programming the MachXO2

Using ispVM System software, users can scan and perform JTAG operations, including programming, with the MachXO2 device.

Setting Up Windows HyperTerminal

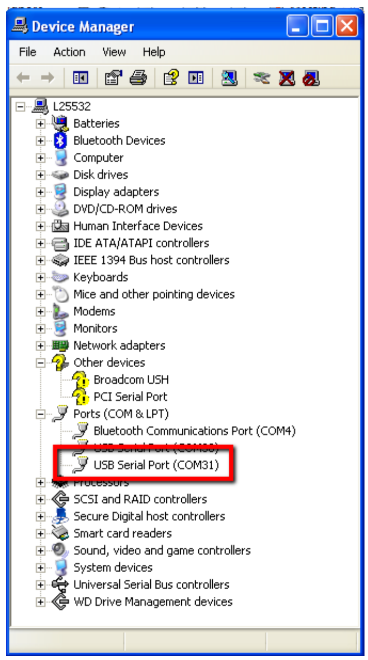
You will use a terminal program to communicate with the evaluation board. The following instructions describe the Windows HyperTerminal program which is found on most Windows PCs. You may use another terminal program but setup will be somewhat different. Windows 7 does not include HyperTerminal. Tera Term has been verified to work with Windows 7. For Linux, Minicom is a good alternative.

Note: This step uses the procedure for Windows XP users. Steps may vary slightly if using another Windows version.

1. From the **Start** menu, select **Control Panel > System**. The "System Properties" dialog appears.

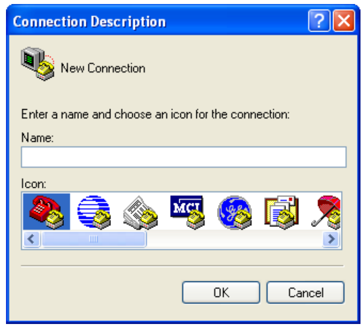
2. Select the **Hardware** tab and click **Device Manager**. The "Device Manager" dialog appears.

Figure 4. Device Manager – COM Port



3. Expand the **Ports (COM & LPT)** entry and note the COM port number for the USB Serial Port.
4. From the **Start** menu, select **Programs > Accessories > Communications > HyperTerminal**. The HyperTerminal application and a "Connection Description" dialog appear.

Figure 5. New Connection – COM Port



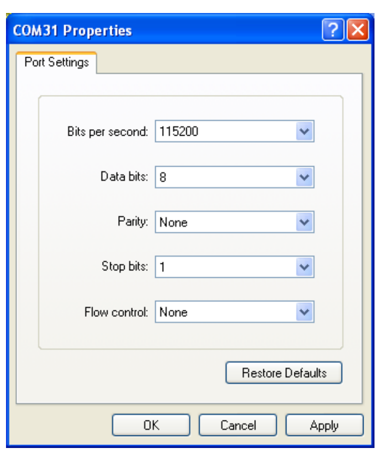
5. Specify a Name and Icon for the new connection. Click **OK**. The "Connect To" dialog appears.
6. Select the COM port identified in Step 3 from the Connect using: list. Click **OK**.

Figure 6. Selecting the COM Port



7. The "COMn Properties" dialog appears where "n" is the COM port selected from the list.
8. Select the following Port Settings and click **OK**.
   Bits per second: **115200**
   Data bits: **8**
   Parity: **None**
   Stop bits: **1**
   Flow control: **None**

Figure 7. COM Port Properties



9. The HyperTerminal window appears.
10. From the MachXO2 Pico Evaluation Board, press the reset push-button with reference designator S1. The Pico SoC demo main menu appears.

Setting Up Linux Minicom

Minicom is a terminal program found with most Linux distributions. It can be used to communicate with the MachXO2 Pico Evaluation Board.

To setup Minicom:

1. Check active serial ports:

   #dmesg | grep tty

   Note the tty label assigned to the USB port

2. From a command prompt, start Minicom:
   #minicom –s

   The configuration menu appears.

3. Highlight **Serial port setup** and press **Enter**. Serial port settings appear.
4. Press **A** (Serial Device). Specify the active serial device noted in Step 1 and press **Enter**.
5. Press **E** (Bps/Par/Bits). Specify **115200**, **None**, **8** and press **Enter**.
6. Press **F** (Hardware Flow Control). Specify **None** and press **Enter**.
7. Press **Esc**. The configuration menu appears.
8. Select **Save setup as dfl**. Minicom saves the port setup as the new default.
9. Select **Exit**. The Minicom interface appears.
10. From the evaluation board, press the **S1** push-button (GSR). The Pico SoC demo main menu appears.

Ordering Information

Description	Ordering Part Number	China RoHS Environment-Friendly Use Period (EFUP)
MachXO2 Pico Development Kit	LCMXO2-1200ZE-P-EVN	

Technical Support Assistance

Hotline: 1-800-LATTICE (North America)
+1-503-268-8001 (Outside North America)
e-mail: techsupport@latticesemi.com
Internet: www.latticesemi.com

Revision History

Date	Version	Change Summary
February 2011	01.0	Initial release.
April 2011	01.1	Updated Pico Evaluation Board Top Side diagram, Pico SoC Demo block diagram, HyperTerminal User Manual information, Appendix A and Appendix B.
June 2011	01.2	Added Appendix C.
July 2011	01.3	Updated Features list with information on migration from MachXO2-1200-R1 to Standard (non-R1) devices.
July 2011	01.4	Added limitations section to Appendix C.
December 2011	01.5	Added Appendix D.
February 2012	01.6	Updated document with new corporate logo.
June 2012	01.7	Added Appendix D, Dual Boot Demonstration.
		Updated Appendix E, Limitations.
June 2012	01.8	Added "MachXO2 Pico Evaluation Board I^2C Bus Power Enable" diagram to Appendix D.
July 2012	01.9	Appendix D figure title changed from "MachXO2 Pico Evaluation Board I^2C Bus Power Enable" to "MachXO2 Pico Evaluation Board SPI/I^2C Bus Power Enable".
October 2012	02.0	Highlighted board limitations and workarounds in the demos.

Appendix A. Schematic

Figure 8. USB 5V, MachXO2 Power Rails, 3.0V Battery, 1.2V Rail and Current Monitors

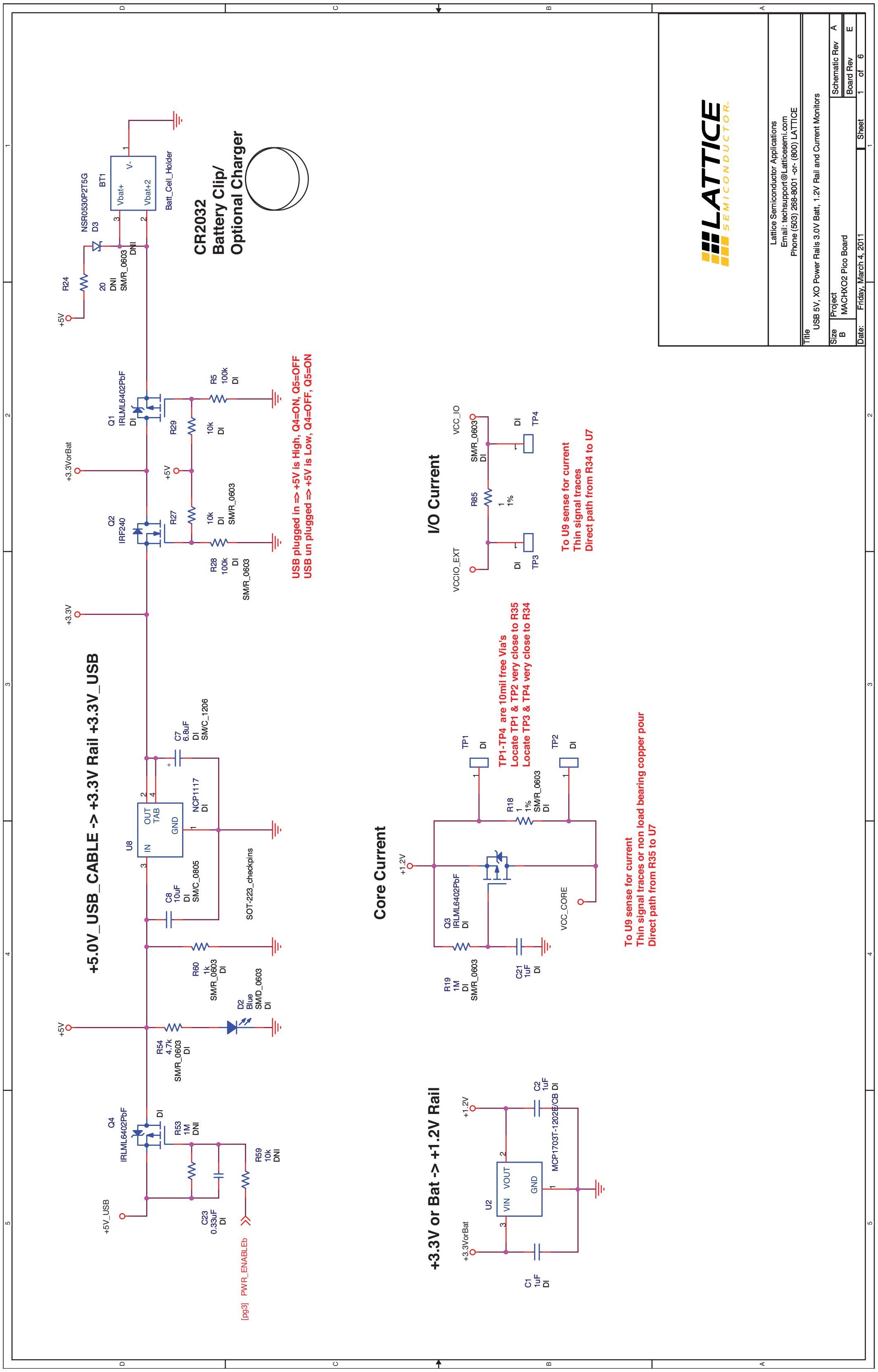


Figure 9. Current Sense Amplifiers, Power Enable Mux

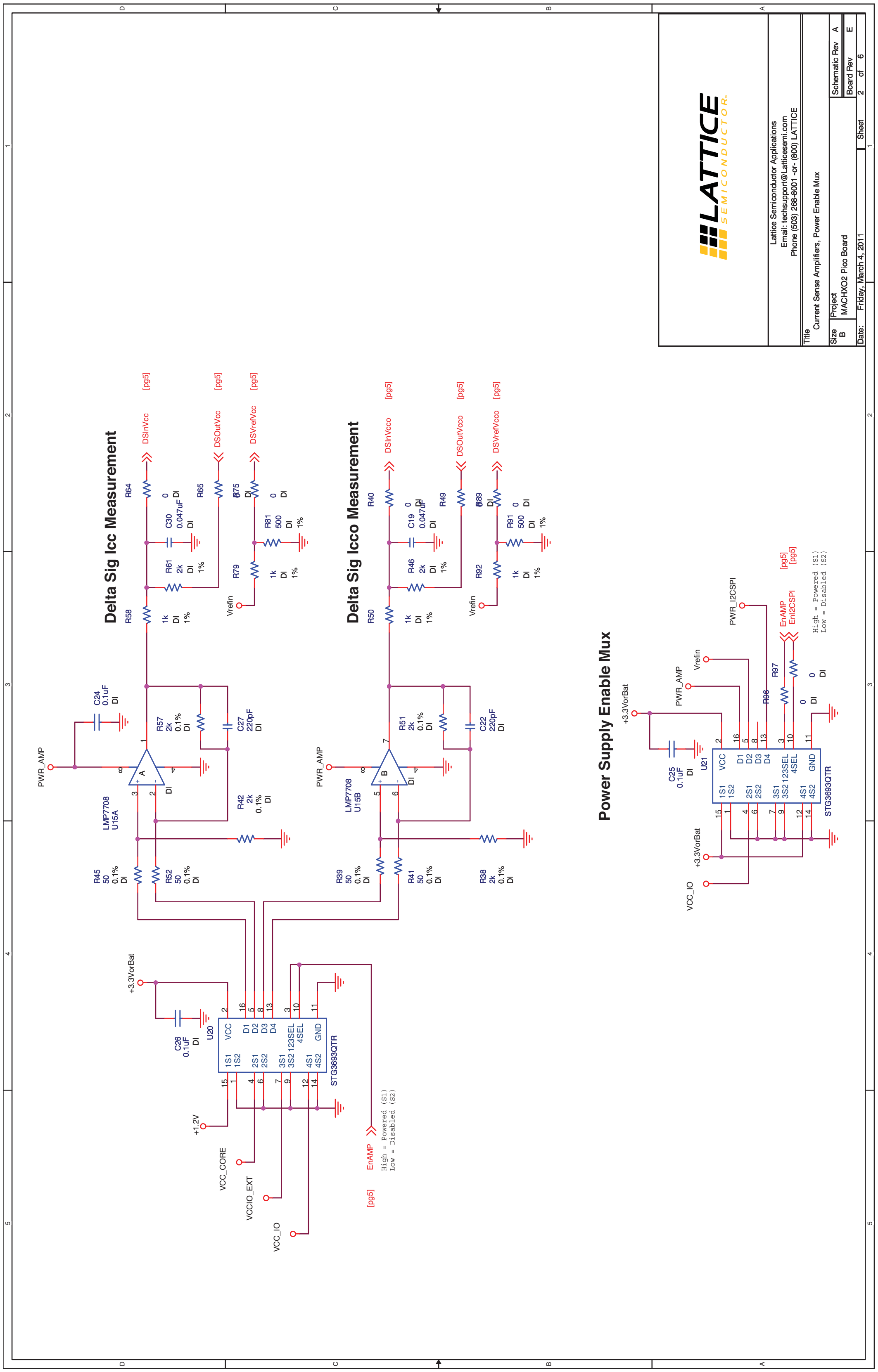


Figure 10. USB to JTAG and I²C for the MachXO2

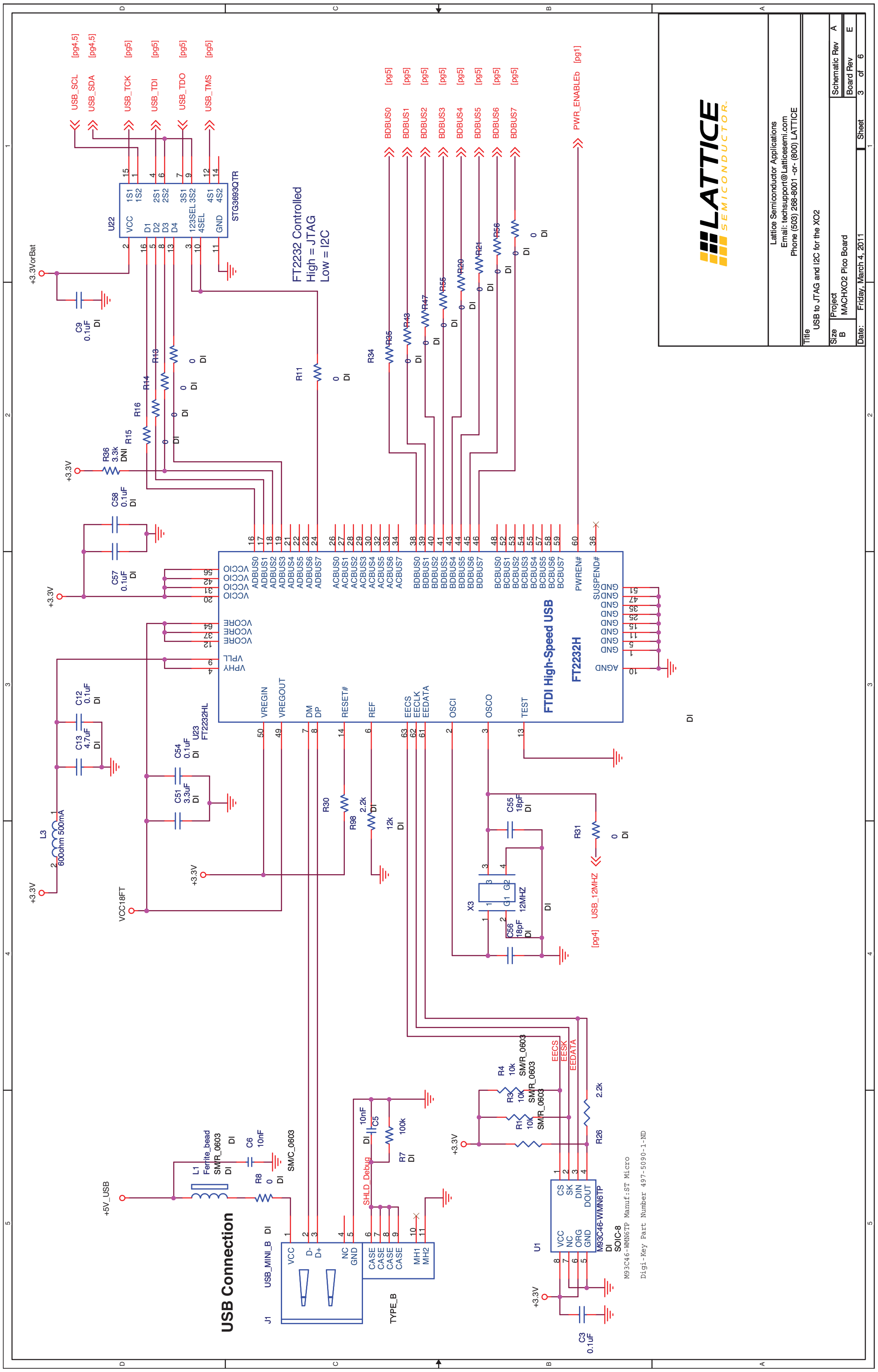


Figure 11. MachXO2 Banks 0-1, LCD, I²C Temperature

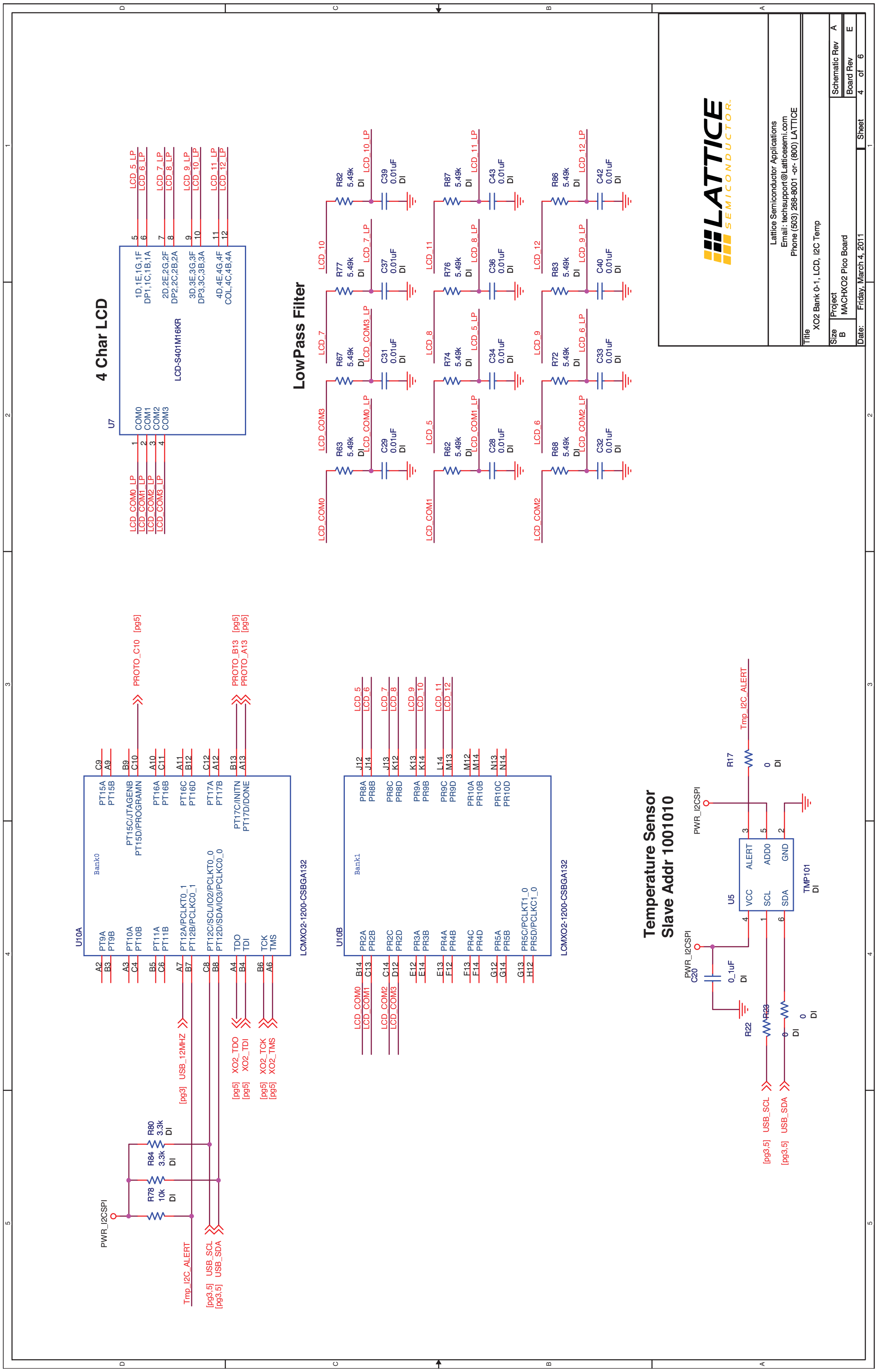


Figure 12. MachXO2 Banks 2-3, Capacitor Pads, Expansion Header, SPI

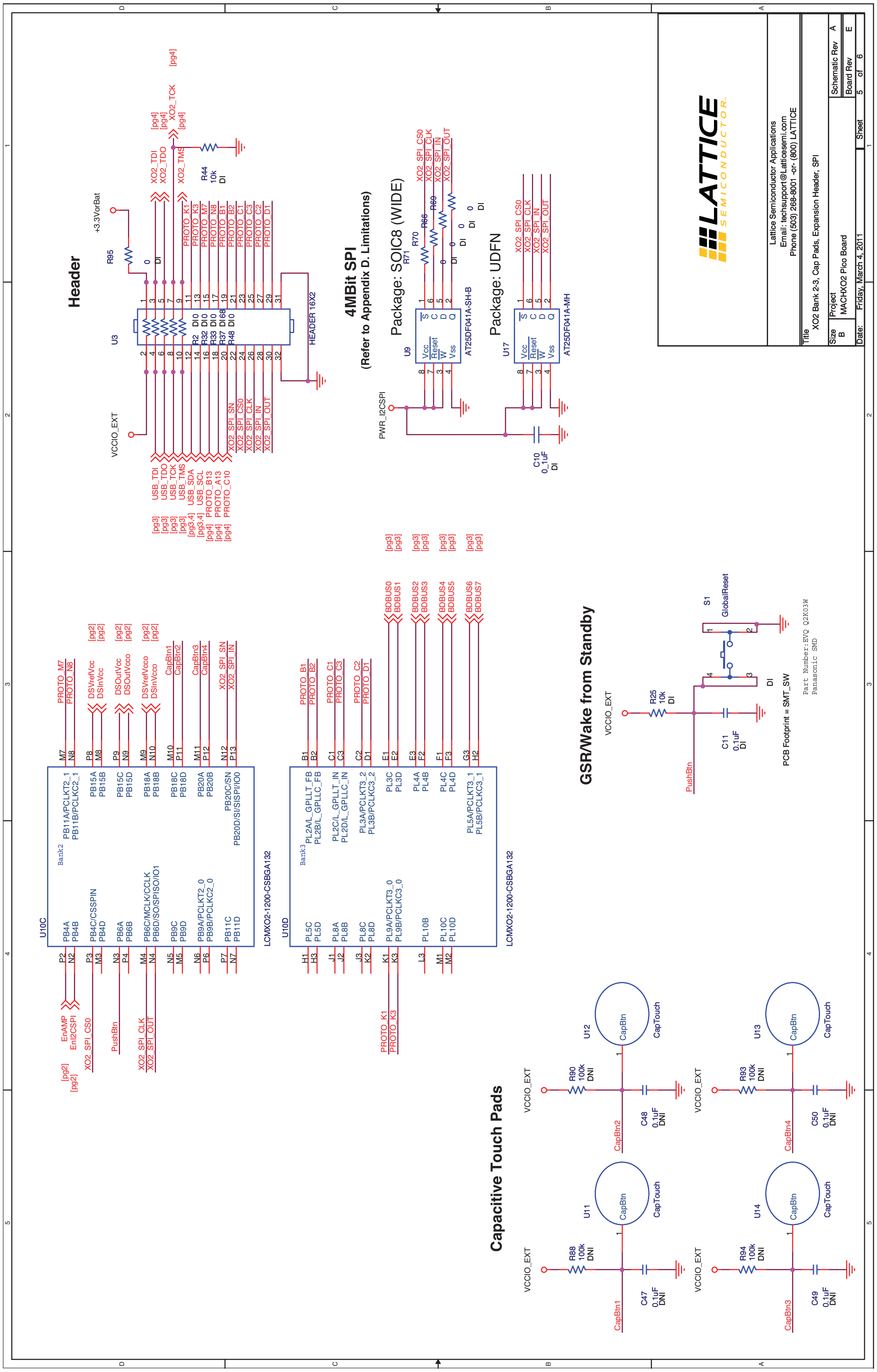
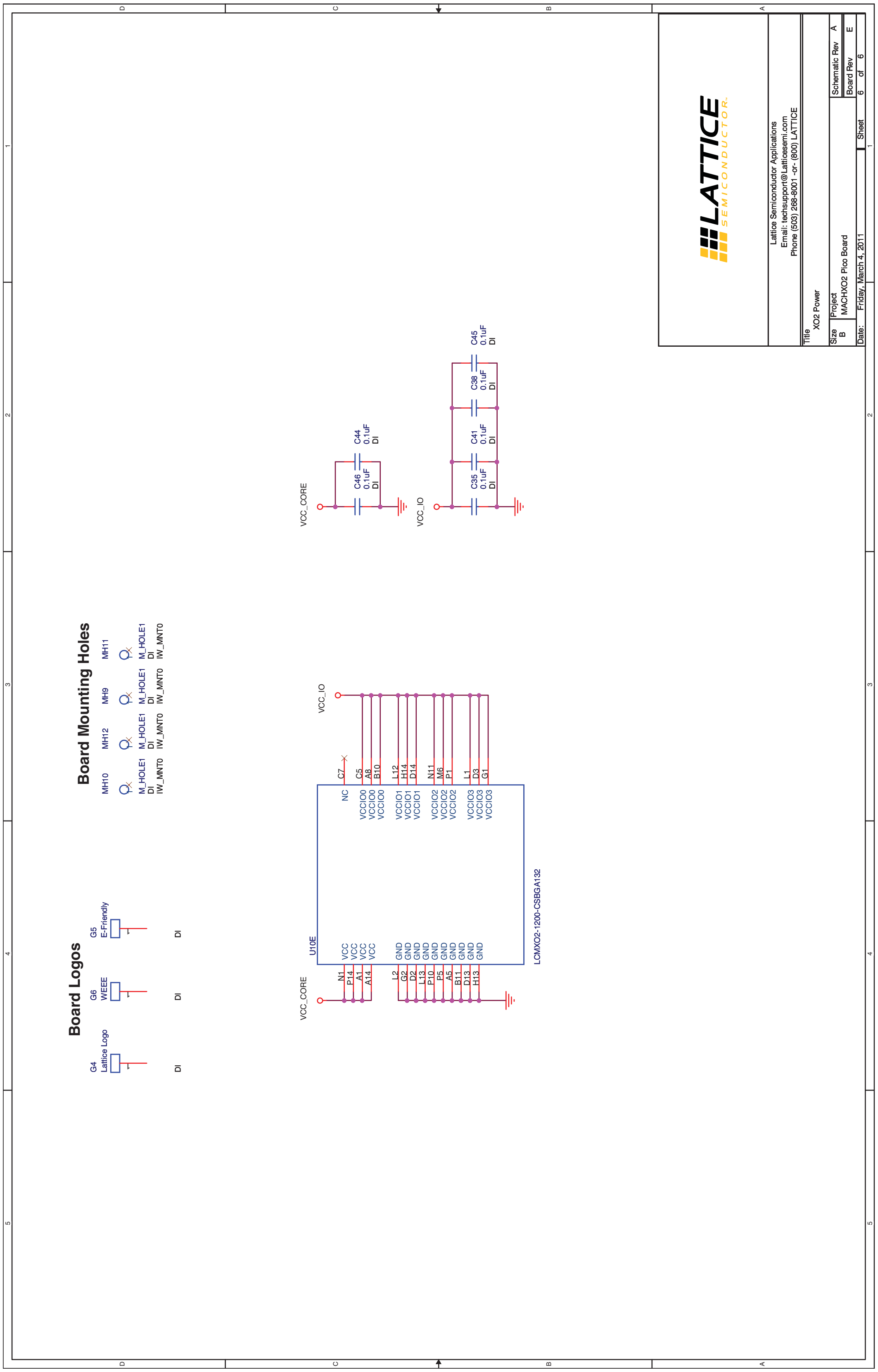


Figure 13. MachXO2 Power



Appendix B. Bill of Materials

Item	Quantity	Reference	Part	Footprint	Populate	Vendor	Part Number	Description
1	2	C10,C20	0_1uF	SM/C_0603	DI	Panasonic	ECJ-1VB1C104K	0.1uF surface mount cap
2	3	C1,C2,C21	1uF	SM/C_0603	DI	Panasonic	ECJ-2YB1A105K	1uF surface mount cap
3	2	C5,C6	10nF	SM/C_0603	DI	Panasonic ECG	ECJ-1VB1C104K	10nF SMC
4	1	J1	USB_MINI_B	TYPE_B	DI	Hirose	UX60-MB-5ST	USBType-BMiniConnector
5	35	R2,R8,R11,R13,R14,R15,R16,R17,R20,R21,R22,R23,R31,R32,R33,R34,R35,R40,R43,R47,R48,R49,R55,R56,R64,R65,R66,R69,R70,R71,R75,R89,R95,R96,R97	0	SM/R_0603	DI	Panasonic ECG	ERJ-3GEY0R00V	Resistor 0.0 SMD 0603
6	5	R50,R58,R60,R79,R92	1k	SM/R_0603	DI	Vishay/Dale	CRCW06031K00FKEA	Resistor 1k SMD 0603
7	8	R1,R3,R4,R25,R27,R29,R44,R78	10k	SM/R_0603	DI	Vishay/Dale	CRCW060310K0FKEA	10K 0603 SMT resistor
8	1	R59	10k	SM/R_0603	DNI	Vishay/Dale	CRCW060310K0FKEA	10K 0603 SMT resistor
9	1	U1	M93C46-WMN6TP	SOIC-8	DI	STMicroelectronics	M93C46-WMN6TP	IC 1K EEPROM 8-SOIC
10	1	U5	TMP101	SM/SOT23_6	DI	TI	TMP101NA/250	IC TEMP SENSOR DIG SOT-23-6
11	1	R19	1M	SM/R_0603	DI	PanasonicECG	ERJ-3GEYJ105V	RES 1.0M1/10W5%
12	1	R53	1M	SM/R_0603	DNI	PanasonicECG	ERJ-3GEYJ105V	RES 1.0M1/10W5%
13	1	U17	AT25DF041A-MH	UDFN	DNI	Atmel	AT25DF041A-MH	IC FLASH 4MBIT 70MHZ 8SOIC
14	4	MH9,MH10,MH11,MH12	M_HOLE1	IW_MNT0	DI	3M	SJ-5003 (BLACK)	BUMPON HEMISPHERE .44X.20 BLACK
15	6	R38,R42,R46,R51,R57,R61	2k	SM/R_0603	DI	Susumu Co Ltd	RG1608P-202-B-T5	RES 2.0K OHM 1/10W .1% 0603 SMD
16	1	BT1	Batt_Cell_Holder	BA2032_Battery_Holder	DI	Linx Technologies Inc	BAT-HLD-001	HOLDER BATTERY 20MM COIN CR2032
17	16	C3,C9,C11,C12,C24,C25,C26,C35,C38,C41,C44,C45,C46,C54,C57,C58	0.1uF	SM/C_0603	DI	TDK Corporation	C1608X7R1E104K	CAP CER .10UF 25V X7R 10% 0603
18	4	C47,C48,C49,C50	0.1uF	SM/C_0603	DNI	TDK Corporation	C1608X7R1E104K	CAP CER .10UF 25V X7R 10% 0603
19	12	C28,C29,C31,C32,C33,C34,C36,C37,C39,C40,C42,C43	0.01uF	SM/C_0603	DI	TDK Corporation	C1608X7R1H103K	CAP CER 10000PF 50V X7R 10% 0603
20	1	C23	0.33uF	SM/C_0603	DI	TDK Corporation	C1608X7R1A334K	CAP CER .33UF 10V X7R 0603
21	1	C7	6.8uF	SM/C_1206	DI	AVX Corporation	TAJA685K020RNJ	CAP TANTALUM 6.8UF 20V 10% SMD
22	1	C8	10uF	SM/C_0805	DI	Nichicon	TAJA685K020RNJ	CAP TANTALUM 10UF 6.3V 20% SMD
23	1	D2	Blue	SM/D_0603	DI	Lite-On Inc	LTST-C190TBKT	LED 468NM BLUE CLEAR 0603 SMD
24	1	L1	Ferrite_bead	SM/R_0603	DI	Laird-Signal Integrity Products	MI0603J600R-00	FERRITE 1A 60 OHM 0603 SMD
25	1	U2	MCP1703T-1202E/CB	SOT-23A-3	DI	Microchip Technology	MCP1703T-1202E/CB	IC REG LDO 1.2V 200MA SOT-23A
26	3	R5,R7,R28	100k	SM/R_0603	DI	Panasonic - ECG	ERJ-3GEYJ104V	RES 100K OHM 1/10W 5% 0603 SMD
27	4	R88,R90,R93,R94	100k	SM/R_0603	DNI	Panasonic - ECG	ERJ-3GEYJ104V	RES 100K OHM 1/10W 5% 0603 SMD
28	1	R54	4.7k	SM/R_0603	DI	Panasonic - ECG	ERJ-3EKF4701V	RES 4.70K OHM 1/10W 1% 0603 SMD
29	2	R26,R30	2.2k	SM/R_0603	DI	Panasonic - ECG	ERJ-3GEYJ222V	RES 2.2K OHM 1/10W 5% 0603 SMD
30	4	R39,R41,R45,R52	50	SM/R_0603	DI	Vishay/Dale	TNPW060349R9BEEA	RES 49.9 OHM 1/10W 0.1% 0603
31	2	R81,R91	500	SM/R_0603	DI	Panasonic - ECG	ERJ-3EKF4990V	RES 499 OHM 1/10W 1% 0603 SMD

Item	Quantity	Reference	Part	Footprint	Populate	Vendor	Part Number	Description
32	1	R98	12k	SM/R_0603	DI	Panasonic - ECG	ERA-3AEB123V	RES 12K OHM 1/10W .1% 0603 SMD
33	3	Q1,Q3,Q4	IRLML6402PbF	SM/SOT23_123	DI	International Rectifier	IRLML6402TRPBF	MOSFET P-CH 20V 3.7A SOT-23
34	1	Q2	IRF240	SM/SOT23_123	DI	International Rectifier	IRLML2502TRPBF	MOSFET N-CH 20V 4.2A SOT-23
35	1	S1	GlobalReset	SMT_SW	DI	Panasonic - ECG	EVQ-Q2K03W	SWITCH LT 6MM 130GF H=3.1MM SMD
36	1	U8	NCP1117	SOT-223_checkpins	DI	STMicroelectronics	NCP1117ST33T3G	IC REG LDO 1A 3.3V SOT223
37	1	U3	HEADER 16X2	Header16x2	DNI	Samtec Inc	TLW-108-06-G-D	CONN HEADER .100" 16POS DL GOLD
38	2	C19,C30	0.047uF	SM/C_0603	DI	TDK Corporation	C1608X7R1H473K	CAP CER 47000PF 50V X7R 10% 0603
39	2	R18,R85	1	SM/R_0603	DI	Vishay/Dale	CRCW06031R00FKEA	RES 1.00 OHM 1/10W 1% 0603 SMD
40	1	D3	NSR0530P2T5G	SM/SOD_923	DNI	ON Semiconductor	NSR0530P2T5G	DIODE SCHOTTKY 30V 0.5A SOD-923
41	1	R24	20	SM/R_0603	DNI	Panasonic - ECG	ERJ-3GEYJ200V	RES 20 OHM 1/10W 5% 0603 SMD
42	2	R80,R84	3.3k	SM/R_0603	DI	Rohm Semiconductor	MCR03EZPJ332	RES 3.3K OHM 1/10W 5% 0603 SMD
43	1	R36	3.3k	SM/R_0603	DNI	Rohm Semiconductor	MCR03EZPJ332	RES 3.3K OHM 1/10W 5% 0603 SMD
44	1	U10	LCMXO2-1200-CSBGA132	CSBGA132	DI	Lattice	LCMXO2-1200-CSBGA132	LCMXO2-1200-CSBGA132
45	1	U7	LCD-S401M16KR	LCD-S401M16KR	DI	Lumex Opto/Components Inc	LCD-S401M16KR	LCD custom order from phil@duerfeldtengineering.com
46	12	R62,R63,R67,R68,R72,R74, R76,R77,R82,R83,R86,R87	5.49k	SM/R_0603	DI	Panasonic - ECG	ERJ-3EKF5491V	RES 5.49K OHM 1/10W 1% 0603 SMD
47	1	R37	68	SM/R_0603	DI	Panasonic - ECG	ERJ-3GEYJ680V	RES 68 OHM 1/10W 5% 0603 SMD
48	2	C55,C56	18pF	SM/C_0603	DI	TDK Corporation	C1608C0G1H180J	CAP CER 18PF 50V C0G 5% 0603
49	1	C51	3.3uF	SM/C_0603	DI	TDK Corporation	C1608X5R0J335K	CAP CER 3.3UF 6.3V X5R 0603
50	1	C13	4.7uF	SM/C_0603	DI	TDK Corporation	C1608X5R0J475K	CAP CER 4.7UF 6.3V X5R 0603
51	1	L3	600ohm 500mA	FB0603	DI	Murata Electronics North America	BLM18AG601SN1D	FERRITE CHIP 600 OHM 500MA 0603
52	1	U23	FT2232HL	tqfp64_0p5_12p2 x12p2_h1p6	DI	Future	FT2232H R	USB UART/FIFO
53	1	X3	12MHZ	crystal_4p_3p2x2 p5	DI	TXC CORPORATION	7M-12.000MAAJ-T	CRYSTAL 12.000 MHZ 18PF SMD
54	3	U20,U21,U22	STG3693QTR	QFN	DI	STMicroelectronics	STG3693QTR	IC SWITCH QUAD SPDT 16QFN
55	1	U15	LMP7708	MSOP	DI	STMicroelectronics	LMP7708MM/NOPB	IC AMP PREC R-R OUT DUAL 8-MSOP
56	2	C22,C27	220pF	SM/C_0603	DI	TDK Corporation	C1608X7R1H221K	CAP CER 220PF 50V X7R 10% 0603
57	1	U9	AT25DF041A-SH-B	AT25DF041A-SOIC-8	DI	Atmel	AT25DF041A-SH-B	IC FLASH 4MBIT 70MHZ 8SOIC
58	1	G4	Lattice Logo	LOGO300_1000	DI			
59	1	G5	E-Friendly	EFRIENDLY_400 _SM	DI			
60	1	G6	WEEE	WEEE_SM	DI			
61	4	TP1,TP2,TP3,TP4	TP	LOGO300_1000	DI			
62	4	U11,U12,U13,U14	CapTouch	CapTouch				

Appendix C. SPI Programming

- In order to support SPI programing of the MachXO2 device the zero ohm resistors (R71, R70, R66, R69) will have to be removed
- Once removed, the SPI programming pins can be accessed via the header U3 (XO2_SPI_OUT, XO2_SPI_IN, XO2_SPI_CLK, XO2_SPI_SN)
  - Programming is supported using Diamond Programmer\ispVM or using an external processor
  - As defined in "Appendix E. Limitations" on page 21 the signal XO2_SPI_CLK is recommended to have a 1K Ohm pull up to VCC_IO

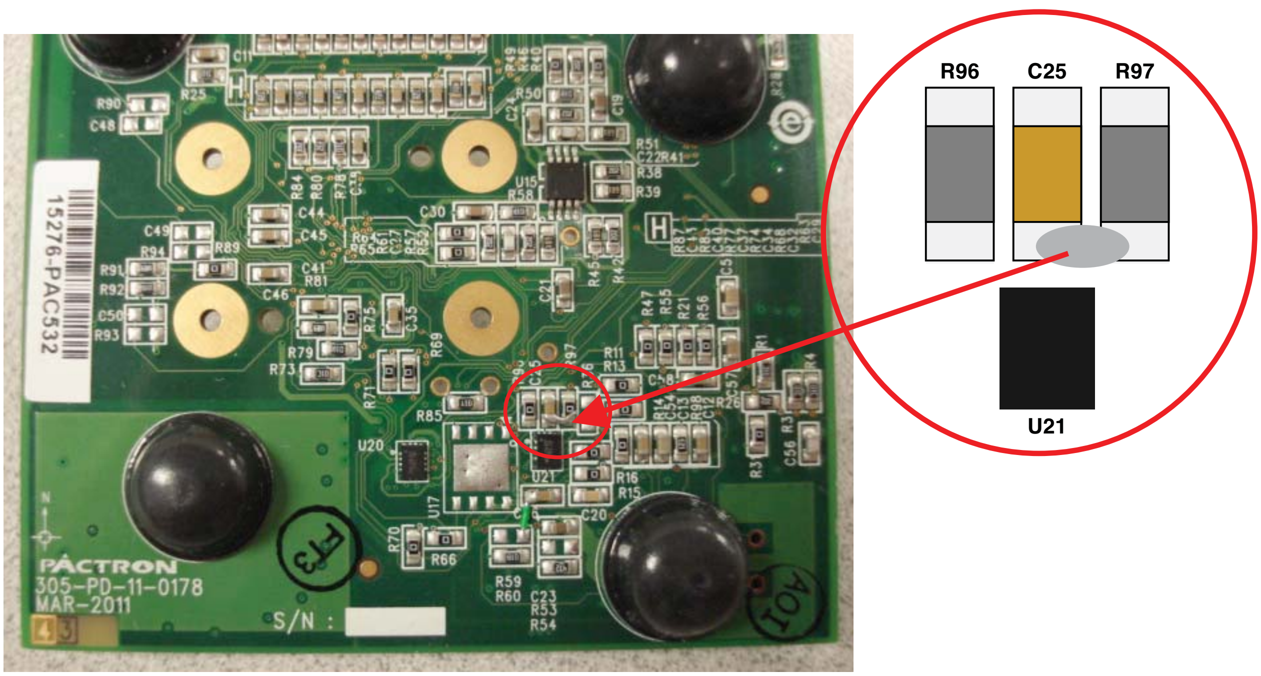
Appendix D. Dual Boot Demonstration

You can demonstrate MachXO2 dual boot using the MachXO2 Pico Evaluation Board.

Before you start you will need to do the following:

1. Create a SVF file to erase only the Configuration Flash and UFM memory. Do NOT erase the Feature Row.
   a. Use ispVM or Diamond Programmer to create a SVF file with the which erases the device as a baseline.
   b. Modify your SVF to change the following:
      ! Shift in ISC ERASE(0x0E) instruction
      SIR 8 TDI (0E);
      SDR 8 TDI (0C); ! Change from E=1110 to C=1100 no Feature Row
   c. For more information on the Feature Row, refer to TN1204, MachXO2 Programming and Configuration Usage Guide.
2. Update the MachXO2 Pico Demo to enable dual boot.
   a. Using Diamond in the Spreadsheet View, Global Preference tab set MASTER_SPI_PORT=ENABLE.
3. Power-on the SPI memory on the MachXO2 Pico Evaluation Board.
   a. This is a low power board and if something is not used it is powered down. This can done by shorting the south side of C25 and R97 by soldering or holding a probe on them as they are beside each other. For reference, the north side of the board has the header U3. Shorting these components provides sets the mux U21 select high powering up the SPI device.
   b. For more information, refer to the board schematics in “Appendix A. Schematic” on page 10.
4. As defined in “Appendix E. Limitations” on page 21 the signal XO2_SPI_CLK is recommended to have a 1K Ohm pull up to VCC_IO.

Figure 14. MachXO2 Pico Evaluation Board SPI/I^{2}C Bus Power Enable



Demonstrating Dual Boot

1. Program the MachXO2 device with the modified Pico Demo.
   a. Select the operation Flash Erase, Program, Verify.
   b. "PICO" will display on the LCD showing that it is running.
2. Program the SPI Flash (SPI-AT25DF041A) on the board with the modified Pico Demo.
   a. Using ispVM or Diamond Programmer the SPI Flash can be programmed with the SPI Flash Programming option.
   b. As defined in TN1204, MachXO2 Programming and Configuration Usage Guide, the starting address must be 0x010000.
3. Reprogram the MachXO2 device with the modified Pico Demo as the Feature Row was erased when the SPI was programmed.
4. Erase the MachXO2 Flash (and not the Feature Row) using the modified SVF file.
5. Power cycle and watch dual boot in action as the MachXO2 loads the image from the SPI into the SRAM.
   a. "PICO" will display on the LCD showing that it is running.
   b. The Flash can be read back, confirming that the SRAM image came from the SPI memory.

Appendix E. Limitations

- Pin A7 USB_12MHz clock should be an input unless R31 is removed to ensure FTDI device operation
- Pin B9 JTAGENB is not connected on the board
- It is recommended to have a 1K Ohm pull up on MachXO2 pin MCLK (signal XO2_SPI_CLK)